WHAT IS CLAIMED IS:

1. A method of identifying a point defect distribution in a silicon single crystal ingot, comprising the steps of:
(a) slicing a first silicon single crystal ingot in an axial direction thereof, the ingot pulled from a first silicon melt at a varying pull rate, to prepare a reference sample including a region [V], a region [Pv], a region [Pi], and a region [I];
(b) coating a surface of the reference sample with a transition metal solution in which a transition metal is dissolved at a concentration of 1 to 1000 ppm to metal-contaminate the reference sample;
(c) heat-treating the metal-contaminated reference sample in an atmosphere of argon, nitrogen, oxygen, hydrogen, or a mixed gas thereof either at temperatures of 600 to 1200°C for 0.5 to 24 hours while increasing the temperature at a rate of 0.5 to 10°C/minute, or at temperatures of 600 to 1100°C for 10 to 60 seconds while increasing the temperature at a rate of 30 to 70°C/second, to diffuse the transition metal in the reference sample;
(d) measuring a concentration of recombination centers formed by the transition metal in the entire heat-treated reference sample;
(e) measuring recombination lifetimes associated with the transition metal in the entire heat-treated reference sample;
(f) producing a correlation line between the concentration

of recombination centers and the recombination lifetimes from measurement results obtained in the step (d) and the step (e), and defining regions including at least the region [Pv] and the region [P] as well as a boundary thereof in the reference sample;

(g) slicing a second silicon single crystal ingot, in an axial direction thereof, the second silicon single crystal ingot pulled from a second silicon melt at a predetermined pull rate, to prepare a measurement sample including at least a region [Pv] and a region [Pi];

(h) coating a surface of the measurement sample with the same transition metal solution as the transition metal solution to metal-contaminate the measurement sample;

(i) heat-treating the metal-contaminated measurement sample under the same conditions as those in the step (c) to diffuse the transition metal in the measurement sample;

(j) measuring a recombination lifetime associated with the transition metal in the entire heat-treated measurement sample; and

(k) checking results of the measuring in the step (j) against the correlation line to infer the region [Pv] and the region [Pi] as well as a boundary thereof;

wherein the reference sample and the measurement sample that have been sliced are such that an oxygen concentration thereof is within the range of 8.0×10^{17} to 1.0×10^{18} atoms/cm^3, or that a boundary between the region [Pv] and the region [Pi] is unidentifiable in the samples when their recombination lifetimes are measured after the samples are

heat-treated at 800°C for 4 hours in a nitrogen atmosphere and subsequently further heat-treated at 1000°C for 16 hours; and

wherein the region [V] is a region in which vacancy-type point defects are predominant and defects in which excessive vacancies are agglomerated are contained, the region [Pv] is a region in which vacancy-type point defects are predominant and defects in which vacancies are agglomerated are not contained, the region [Pi] is a region in which interstitial silicon-type point defects are predominant and defects in which interstitial silicons are agglomerated are not contained, and the region [I] is a region in which interstitial silicon-type point defects are predominant and defects in which interstitial silicons are agglomerated are contained.

2. The method according to claim 1, wherein the transition metal is Fe, Ni, Cu, or Co.

3. The method according to claim 1, wherein the concentration of recombination centers formed in the silicon single crystal by the heat-treating for diffusing the transition metal is measured using a DLTS (deep level transient spectroscopy) method.

4. The method according to claim 1, wherein the recombination lifetimes subsequent to the heat-treating for diffusing the transition metal is measured using an LM-PCD

(laser/microwave photoconductivity decay) method.

5. A method of identifying a point defect distribution in a silicon single crystal ingot, comprising the steps of:
(a) slicing a first silicon single crystal ingot in an axial direction thereof, the first silicon single crystal ingot pulled from a first silicon melt at a varying pull rate, to prepare first and second reference samples each including a region [V], a region [Pv], a region [Pi], and a region [I];
(b) coating each of the surfaces of the first and second reference samples with a first and second transition metal solutions in which respective different transition metals are dissolved at a concentration of 1 to 1000 ppm to metal-contaminate the reference samples;
(c) heat-treating the metal-contaminated first and second reference samples in an atmosphere of argon, nitrogen, oxygen, hydrogen, or a mixed gas thereof either at temperatures of 600 to 1200°C for 0.5 to 24 hours while increasing the temperature at a rate of 0.5 to 10°C/minute, or at temperatures of 600 to 1100°C for 10 to 60 seconds while increasing the temperature at a rate of 30 to 70°C/second, to diffuse the transition metals in the first and second reference samples;
(d) measuring a concentration of recombination centers formed by the transition metal in the entire heat-treated first reference sample;
(e) measuring recombination lifetimes associated with the

transition metal in the entire heat-treated second reference sample;

(f) producing a correlation line between the concentration of recombination centers and the recombination lifetimes from measurement results obtained in the step (d) and the step (e), and defining regions including at least the region [Pv] and the region [Pi] as well as a boundary thereof in the first reference sample;

(g) slicing a second silicon single crystal ingot in an axial direction thereof, the second silicon single crystal ingot pulled from a second silicon melt at a predetermined pull rate, to prepare a measurement sample including at least a region [Pv] and a region [Pi];

(h) coating a surface of the measurement sample with a third transition metal solution that is the same as the second transition metal solution to metal-contaminate the measurement sample;

(i) heat-treating the metal-contaminated measurement sample under the same conditions as those in the step (c) to diffuse the transition metal in the measurement sample;

(j) measuring a recombination lifetime associated with the transition metal in the entire heat-treated measurement sample; and

(k) checking results of the measuring in the step (j) against the correlation line to infer the region [Pv] and the region [Pi] as well as a boundary thereof;

wherein the first and second reference samples and the measurement sample that have been sliced are such that an

oxygen concentration thereof is within the range of 8.0×10^{17} to 1.0×10^{18} atoms/cm^3, or that the boundary between the region [Pv] and the region [Pi] is unidentifiable in the samples when their recombination lifetimes are measured after the samples are heat-treated at 800°C for 4 hours in a nitrogen atmosphere and subsequently further heat-treated at 1000°C for 16 hours; and

wherein the region [V] is a region in which vacancy-type point defects are predominant and defects in which excessive vacancies are agglomerated are contained, the region [Pv] is a region in which vacancy-type point defects are predominant and defects in which vacancies are agglomerated are not contained, the region [Pi] is a region in which interstitial silicon-type point defects are predominant and defects in which interstitial silicons are agglomerated are not contained, and the region [I] is a region in which interstitial silicon-type point defects are predominant and defects in which interstitial silicons are agglomerated are contained.

6. The method according to claim 5, wherein the transition metal is Fe, Ni, Cu, or Co.

7. The method according to claim 6, wherein, when the transition metal is Ni or Co, a second reference sample and the measurement sample are chemically etched at a thickness within the range of 500 to 1000 μm after the second reference sample and the measurement sample have been

coated with the solution in which Ni or Co is dissolved and have been heat-treated, and their recombination lifetimes associated with the transition metal are measured before and after the chemical etching of the second reference sample and the measurement sample.

8. The method according to claim 6, wherein the first reference sample is coated with a solution in which Fe is dissolved, and the second reference sample and the measurement sample are coated with a solution in which Ni or Co is dissolved.

9. The method according to claim 5, wherein the concentration of recombination centers formed in the silicon single crystal by the heat-treating for diffusing the transition metal is measured using a DLTS (deep level transient spectroscopy) method.

10. The method according to claim 5, wherein the recombination lifetimes subsequent to the heat-treating for diffusing the transition metal is measured using an LM-PCD (laser/microwave photoconductivity decay) method.

11. A method of identifying a point defect distribution in a silicon single crystal ingot, comprising the steps of: (a) slicing a silicon single crystal ingot in an axial direction thereof, the ingot pulled from a silicon melt at a varying pull rate, to prepare first and second samples

each including a region [V], a region [Pv], a region [Pi], and a region [I];

(b) measuring oxygen concentrations of the first and second samples;

(c) subjecting the first sample to a first heat treatment at 800°C for 4 hours in a nitrogen or oxidizing atmosphere and subsequently to a second heat treatment at 1000°C for 16 hours, when the oxygen concentrations of the first and second samples are 1.2×10^{18} atoms/cm^3 or higher;

(d) measuring recombination lifetimes in the entire heat-treated first sample;

(e) defining a boundary between the region [Pi] and the region [I] in the first sample based on measurement results in the step (d);

(f) subjecting the second sample to a third heat treatment at 1100 to 1200°C for 1 to 4 hours in an oxidizing atmosphere;

(g) selectively etching the second sample subjected to the third heat treatment;

(h) observing the selectively-etched second sample with an optical microscope to identify an oxidation induced stacking fault (OISF) region; and

(i) defining a boundary between the region [V] and the region [Pv] in the second sample based on a result of the observing in the step (h);

wherein the region [V] is a region in which vacancy-type point defects are predominant and defects in which excessive vacancies are agglomerated are contained, the

region [Pv] is a region in which vacancy-type point defects are predominant and defects in which vacancies are agglomerated are not contained, the region [Pi] is a region in which interstitial silicon-type point defects are predominant and defects in which interstitial silicons are agglomerated are not contained, and the region [I] is a region in which interstitial silicon-type point defects are predominant and defects in which interstitial silicons are agglomerated are contained.

12. A method of identifying a point defect distribution in a silicon single crystal ingot, comprising the steps of:
(a) slicing a silicon single crystal ingot in an axial direction thereof, the ingot pulled from a silicon melt at a varying pull rate, to prepare first and second samples each including a region [V], a region [Pv], a region [Pi], and a region [I];
(b) measuring oxygen concentrations of the first and second samples;
(c) subjecting the first sample to a third heat treatment at 1100 to 1200°C for 1 to 4 hours in an oxidizing atmosphere when the oxygen concentrations of the first and second samples are 9.0×10^{17} atoms/cm^3 or lower;
(d) selectively etching the first sample that has been subjected to the third heat treatment;
(e) observing the selectively-etched first sample with an optical microscope to identify an oxidation induced stacking fault (OISF) region;

(f) defining a boundary between the region [V] and the region [Pv] in the first sample based on a result of the observing in the step (e);
(g) selectively etching the second sample;
(h) observing the selectively-etched second sample with an optical microscope to identify an interstitial-type large dislocation region; and
(i) defining a boundary between the region [Pi] and the region [I] in the second sample based on a result of the observing in the step (h);
wherein the region [V] is a region in which vacancy-type point defects are predominant and defects in which excessive vacancies are agglomerated are contained, the region [Pv] is a region in which vacancy-type point defects are predominant and defects in which vacancies are agglomerated are not contained, the region [Pi] is a region in which interstitial silicon-type point defects are predominant and defects in which interstitial silicons are agglomerated are not contained, and the region [I] is a region in which interstitial silicon-type point defects are predominant and defects in which interstitial silicons are agglomerated are contained.

13. A method of identifying a point defect distribution in a silicon single crystal ingot, comprising the steps of:
(a) slicing a silicon single crystal ingot in an axial direction thereof, the ingot pulled from a silicon melt at a varying pull rate, to prepare first and second samples

each including a region [V], a region [Pv], a region [Pi], and a region [I];

(b) measuring oxygen concentrations of the first and second samples;

(c) subjecting the first sample to a first heat treatment at 800°C for 4 hours in a nitrogen or oxidizing atmosphere and subsequently to a second heat treatment at 1000°C for 16 hours, when the oxygen concentrations of the first and second samples are 9.0×10^{17} atoms/cm^3 or less;

(d) measuring recombination lifetimes in the entire heat-treated first sample;

(e) defining a boundary between the region [Pi] and the region [I] and a boundary between the region [V] and the region [Pv] in the first sample based on measurement results in the step (d);

(f) subjecting the second sample to a fourth heat treatment at 700°C to not more than 800°C for 4 to 20 hours or at 800°C for more than 4 to 20 hours in a nitrogen or oxidizing atmosphere and subsequently to a fifth heat treatment at 1000°C for 1 to 20 hours;

(g) measuring recombination lifetimes in the entire heat-treated second sample; and

(h) defining a boundary between the region [Pi] and the region [I] and a boundary between the region [V] and the region [Pv] in the second sample based on measurement results in the step (g);

wherein the region [V] is a region in which vacancy-type point defects are predominant and defects in which

excessive vacancies are agglomerated are contained, the region [Pv] is a region in which vacancy-type point defects are predominant and defects in which vacancies are agglomerated are not contained, the region [Pi] is a region in which interstitial silicon-type point defects are predominant and defects in which interstitial silicons are agglomerated are not contained, and the region [I] is a region in which interstitial silicon-type point defects are predominant and defects in which interstitial silicons are agglomerated are contained.